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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/873,041	06/01/2001	Michael Heuken	03345-P0017A	5097

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EXAMINER

SONG, MATTHEW J

ART UNIT	PAPER NUMBER
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1722

DATE MAILED: 04/15/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/873,041	Applicant(s) HEUKEN ET AL.	
	Examiner Matthew J. Song	Art Unit 1722	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
 - If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
 - If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
 - Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 21 January 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-59 is/are pending in the application.
- 4a) Of the above claim(s) 18,26-28 and 57-59 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-17,19-25 and 29-56 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 21 January 2005 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

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DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. Claims 1-17, 19-25 and 30-56 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter, which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Claim 1 recites, “calculating at least one gradient between at least two of the plurality of temperatures; controlling the plurality of temperatures, using the determined plurality of temperatures, the determined at least one temporal variation and the at least one temperature gradient, in correspondence with a plurality of numerically simulated temperature variation profiles” in lines 23-28. There is no support in the instant specification for controlling the plurality of temperatures using the determined temperature gradient. The instant specification merely teaches controlling the gas outlet, gas mixing system or the upper side of the chamber allows a temperature gradient to be determined on page 7 of the specification. The same arguments apply to independent claims 23 and 30.

3. Claims 1-17, 19-25 and 30-56 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter, which

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was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Claim 1 recites, "calculating at least one gradient between at least two of the plurality of temperatures. There are eight possible temperatures, which can be selected among the plurality of temperatures. The specification does not provide support for the scope for calculating a temperature gradient between any of the eight temperatures. The specification merely teaches a temperature gradient can be calculated for only three specific pairs of temperatures. The specification teaches calculating a temperature gradient between the gas outlet and the wafer supports or the gradient between the gas mixing system and the inlet or the gradient between a upper side of the chamber and the principal wafer support, note page 7 of the specification. The same arguments apply to independent claims 23 and 30.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later

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invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

5. Claim 29 is rejected under 35 U.S.C. 103(a) as being unpatentable over Schmitz et al (“MOVPE growth of InGaN on sapphire using growth initiation cycles”) in view of Burmeister (US 3,617,371) and de Waard et al (US 6,373,033) or Stoddard et al (WO 98/35531).

Schmitz et al discloses a Metal organic chemical vapor deposition, MOCVD, for forming an AlGaInN alloy, where a variety of total flow rates and extremely precise temperature control and uniformity across the entire reactor and the substrate by means of a new multicoil heater system are used to achieve a film with excellent photoluminescence uniformity, this reads on applicant's controlling process parameters in the reaction chamber (Abstract). Schmitz et al also discloses an inductive heater brings a susceptor to a maximum temperature of 1600°C and very fast heat up and cooling cycles up to 6°C/sec can be achieved. Schmitz et al also discloses rapid cooling rates are enhanced because of reduced thermal mass susceptor, water cooled reactor chamber with all thermostated reactor walls. Schmitz et al also discloses reagents are separated in two carrier gas flows that combine at the injector and thermal management of the reactor in particular is a very critical parameter. Schmitz et al also discloses the injection zone is kept at a lower temperature to preserve less stable compounds (col 2-3), this reads on applicant's gas inlet. Schmitz et al also discloses accurate heat transfer calculation are critical because precursor decomposition and formation of deposits are determined by the temperature distribution in the MOCVD reactor. Schmitz et al also discloses precise temperature control of a quartz ceiling, this reads on applicant's upper side of the reaction chamber, inside the reactor is employed to keep

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the inner reactor wall, this reads on applicant's chamber walls, at a suitable elevated temperature to minimize deposits and growth temperatures are adjusted with a precision of 0.1°C. Schmitz et al also discloses total flow rates and the gas flow ratio are used to optimize the growth rate and uniformities while growth rates can be adjusted independently (col 4-5). Schmitz et al also discloses absolute control over the ceiling temperature by employing an in situ monitoring and closed feedback control system and a sensor from 400 to 1900°C with a resolution to 0.1 °C is used, this reads on controlling the temporal variation of the set of process temperatures, and it is possible to monitor the temperature profile of the wafer, satellite and planetary disc and a RF heater is adjustable such that the temperature uniformity of the satellite and planetary disc is optimized, this reads on applicant's first and second wafer support (col 9-12). Schmitz et al also discloses a multiwafer planetary reactor with a rotating susceptor and an exhaust (fig 1).

Schmitz et al does not disclose a gas mixing system.

In a method of growing a III-V layer by vapor phase epitaxy, note entire reference, Burmeister teaches a vapor phase reactor includes separately arranged source, mixing 45 and growing chambers which may be selectively heated inductively to eliminate contaminating decomposition of the reactor walls (col 1, ln 1-67). Burmeister also teaches RF heating coils 65 may be varied to concentrate the heating power at selected portion of the length of the walls and the portion adjacent the mixing chamber operates at approximately 800°C and the term approximately is intended to include values within + 10 percent of the stated value. Burmeister also teaches a temperature sensing means 71 may be connected to a thermocouple 69 for giving a temperature indication or for controlling the RF power from source 67 where desired to maintain close control of operating temperature (col 2, ln 1-75). It would have been obvious to a person of

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ordinary skill in the art at the time of the invention to modify Schmitz et al with Burmeister's mixing chamber to eliminate contaminating decomposition of the reactor walls (col 1, ln 25-40).

The combination of Schmitz et al and Burnmeister et al does not teach controlling the temporal variation of at least one process temperature in correspondence with a numerically simulated temperature variation profile.

In a method of model based predictive control of thermal processing used in semiconductor processing (col 1, ln 10-20), de Waard et al teaches a temperature controller uses the process model to calculate a predicted temperature output over a predetermined future time period. de Waard et al also teaches the model is based on a polynomial model, this reads on applicants' numerical simulated temperature variation profile (col 9, ln 35 to col 10, ln 67). de Waard et al also teaches the temperature controller also comprises a control calculator that uses the predicted nominal temperature output to calculate an optimum strategy by which to control the source of thermal energy (col 4, ln 25-67 and col 36, ln 15-67), this reads on applicants' controlling at least one process temperature and temporal variation thereof in correspondence with a numerically simulated temperature variation profile. It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Schmitz et al and Burnmeister et al by controlling the process temperatures in correspondence to a numeric simulation, as taught by de Waard et al, because de Waard et al method is more effective control system and has improved controller response time (col 9, ln 50-65 and col 4, ln 25-35).

In a method of controlling a thermal reactor, Stoddard et al teaches using a least squares parameter estimation algorithm to obtain estimates of the system parameters which reflect

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temperature response characteristics and controller design employs high performance numerical software, such as MATLAB (pg 22), this reads on applicants' numerical simulated temperature variation profile. Stoddard et al also teaches an on-line model predicts wafer temperature and a plurality of selectable control mode logic circuits which control the heating element in response to the online model (pg 9), this reads on applicants' controlling at least one process temperature and the temporal variation thereof in correspondence with a numerically simulated temperature variation profile. Stoddard et al also teaches using the temperature controller to grow or deposit material on the surface of silicon wafer and using a low pressure chemical vapor deposition process (pg 16). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Schmitz et al and Burnmeister et al by controlling the process temperatures in correspondence to a numeric simulation, as taught by Stoddard et al, because using models provide an accurate indication of temperature during dynamic changes in temperature, thereby improving control (pg 20, ln 15 to pg 21, ln 5).

Response to Arguments

6. Applicant's arguments, see the first full paragraph on pages 17-18 of the remarks, filed 1/21/2005, with respect to Schmitz et al in view of Burnmeister and de Waard et al or Stoddard et al have been fully considered and are persuasive. The rejection of claims 1-17, 19-25 and 30-56 has been withdrawn.

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7. Applicant's arguments with respect to claims 1-17, 19-25 and 30-56 have been considered but are moot in view of the new ground(s) of rejection.

8. Applicant's arguments filed 1/21/2005 have been fully considered but they are not persuasive.

Applicant's argument that the prior art does not teach controlling all eight specifically identified locations of the reactor is noted but is not found persuasive. Schmitz teaches the injection zone is kept at a low temperature (col 2-3), this reads on applicant's T_1 , and precise temperature control of a quartz ceiling and inner reactor wall (col 4-5), this reads on applicant's T_7 and T_2 , respectively. Schmitz also teaches in situ monitoring and control of the satellite and planetary disc, a RF heater and exhaust (col 9-12 and Fig 1), this reads on applicant's T_3 , T_4 , T_8 and T_5 , respectively. Burmeister teaches a controlling the temperature of a gas mixing chamber (col 2, ln 1-67), this reads on applicant's T_6 . Stoddard et al or de Waard teach numerical simulation control of temperature.

Conclusion

9. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Frijlink (US 5,108,540) teaches a device 20 for controlling the temperature of wall opposite a susceptor.

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Flemish et al (US 5,256,595) teaches a hot wall reactor with four temperature zones for deposition, mixing, preheating and injection, where gas flows are controlled by a microprocessor (col 2-3).

Molnar (US 6,086,673) teaches exhaust lines are at a sufficiently high temperature to prevent clogging reactor exhaust lines (col 4, ln 55-67).

Suzuki (US 5,593,608) teaches an improved temperature control method using a feed-forward temperature control method and a feed forward signal is generated by simulation (col 2, ln 50-67 and col 13, ln 1-15).

10. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

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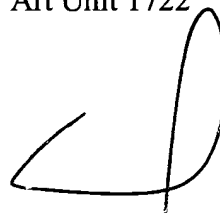
11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew J. Song whose telephone number is 571-272-1468. The examiner can normally be reached on M-F 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Benjamin Utech can be reached on 571-272-1137. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

MJS
April 11, 2005

Matthew J Song
Examiner
Art Unit 1722



ROBERT KUNEMUND
PRIMARY EXAMINER